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Optimizing conditions for labeling of mesenchymal stromal cells (MSCs) with gold nanoparticles: A prerequisite for in vivo tracking of MSCs

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Abstract

© 2017 The Author(s).Background: Mesenchymal stromal cells (MSCs) have an inherent migratory capacity towards tumor tissue in vivo. With the future objective to quantify the tumor homing efficacy of MSCs, as first step in this direction we investigated the use of inorganic nanoparticles (NPs), in particular ca. 4nm-sized Au NPs, for MSC labeling. Time dependent uptake efficiencies of NPs at different exposure concentrations and times were determined via inductively coupled plasma mass spectrometry (ICP-MS). Results: The labeling efficiency of the MSCs was determined in terms of the amount of exocytosed NPs versus the amount of initially endocytosed NPs, demonstrating that at high concentrations the internalized Au NPs were exocytosed over time, leading to continuous exhaustion. While exposure to NPs did not significantly impair cell viability or expression of surface markers, even at high dose levels, MSCs were significantly affected in their proliferation and migration potential. These results demonstrate that proliferation or migration assays are more suitable to evaluate whether labeling of MSCs with certain amounts of NPs exerts distress on cells. However, despite optimized conditions the labeling efficiency varied considerably in MSC lots from different donors, indicating cell specific loading capacities for NPs. Finally, we determined the detection limits of Au NP-labeled MSCs within murine tissue employing ICP-MS and demonstrate the distribution and homing of NP labeled MSCs in vivo. Conclusion: Although large amounts of NPs improve contrast for imaging, duration and extend of labeling needs to be adjusted carefully to avoid functional deficits in MSCs. We established an optimized labeling strategy for human MSCs with Au NPs that preserves their migratory capacity in vivo.

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Keywords

Au nanoparticles (Au NP), labeling, in vivo tracking, Mesenchymal stromal cells (MSCs)

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